

## Ph.D. Course in Materials Science and Nanotechnology

University of Milano-Bicocca, Department of Materials Science, via Cozzi 55, 20125 Milano

**May 31, 2019 – 2.30 p.m.**

**Seminar room - Department of Materials Science U5**

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## Advancements in platinum group metal-free catalyst for oxygen reduction reaction along the entire pH range

Fuel cells are electrochemical devices capable of transforming the chemical energy contained in the fuel (e.g. methanol, hydrogen, etc.) into useful electricity. Generally, fuel cells utilize oxygen as the oxidant. Oxygen reduction reaction (ORR) is of particular importance to fuel cell technology, where it is used across a wide range of temperatures and in extreme pH regions: acidic and alkaline.

At acidic pH, the best catalyst is platinum while in alkaline media palladium is the most performing. In neutral media, enzymes (e.g. multicopper oxidase) showed the highest electrocatalytic activity. However, all these catalysts are expensive and limit fuel cells large-scale commercialization. Recently, platinum group metal-free (PGM-free) catalysts containing a transition metal (e.g. Fe, Co, Mn, Ni) active center have been captured the attention of the scientists' worldwide. The obtained catalysts consist in a graphene-like structure in which the in-plane and edge defects containing the metal and nitrogen (separately or coordinated) are the catalytic sites.

This talk will be focused on PGM-free catalysts and especially:

- 1) effect of the electrolyte pH on the ORR electrocatalysis;
- 2) effect of metal centers (e.g. Fe, CO, Mn, Ni) on the ORR electrocatalysis;
- 3) effect of the catalysts surface chemistry on the ORR electrocatalysis;
- 4) pollutants tolerance of PGM-free catalysts for ORR.

PhD students and all interested in the seminar are kindly invited to participate.

The PhD Coordinator  
Prof. Marco Bernasconi